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INTERSTATE MIGRATION OF TUBERCULOUS PERSONS.

ITS BEARING ON THE PUBLIC HEALTH, WITH SPECIAL REFERENCE TO THE STATES OF TEXAS AND NEW MEXICO.

By ERNEST A. SWEET, Passed Assistant Surgeon, United States Public Health Service.

For many years certain western areas have had well-deserved reputations as health resorts. Colorado was seemingly the first to obtain recognition, but as the country was opened up for settlement, western Texas, New Mexico, and Arizona in turn became the Mecca for health seekers; later California had her name added to the list, becoming a keen rival of the other States in offering attractions to the afflicted. During the early period of the migration of the tuberculous we had practically no knowledge concerning the transmissibility of the disease, and patients so afflicted were not regarded as dangerous to the public health or welfare, while even if they had been they doubtless would have been received in this newly settled country with some degree of cordiality. To-day all this has changed. The public now rightfully considers tuberculosis a communicable disease and every case is regarded as at least a potential source of contamination. The western country to which the afflicted migrate is no longer a struggling section, but has become sturdy and resourceful as well as independent. Manufacturing industries have arisen, congested districts developed, and living conditions differ in but slight respect from those of the East. It is not strange then that any great influx of consumptives should be looked upon with some degree of suspicion, even if actual doubt of the desirability of such a movement be not expressed, and the subject is well worthy of careful investigation. The problem is a many sided one, and any consideration of its social, economic, or public health aspects should be made on more than narrow grounds, for not alone is the welfare of thousands concerned, but life itself in many instances is involved. It was with these facts in mind that the investigation, of which this is a report, was undertaken November 11, 1913.

Climatic Conditions.

The climate of the four States mentioned is in general much the same and a single description will, with slight variations, be sufficient for all.

The entire area is a part of the great western plateau. Beginning at the eastern slope with an altitude of but a few hundred feet, the land gradually rises to 6,000 feet or more, with mountains extending as high again. San Antonio, with an altitude of but 700 feet, is far down the slope; El Paso, at 3,700 feet, is nestled in the valley of the Rio Grande, while Albuquerque occupies a position a mile above sea level. Between these extremes almost any desired altitude may be selected.

The temperature of this vast area varies widely, and not only latitude, but altitude as well, exerts its influence. The summers in Colorado are in general cool, while those in New Mexico and Texas are, in the lower levels, hot, but even here great diversity exists, and by selecting places of sufficient altitude almost any desired temperature may be obtained. In San Antonio there are on an average 94 days a year when the thermometer registers above 90, in El Paso 80, and Santa Fe but 2. On account of the extremely low humidity these high temperatures are less depressing than one would expect, and for the same reason the cold of the winter season is much more bearable. The winters in the southern area are mild and conducive to outdoor life, but in the northern and mountainous regions zero temperatures are often recorded and storms are frequent.

There is an abundance of sunshine and probably but few places in the world can show such a preponderance of cloudless days as these slopes of the Rockies. While the average number of cloudy days at San Antonio, based on the figures for 20 years, is but 99, at El Paso the number decreases to 36, New Mexico giving approximately the same number. The flood of sunshine prevails almost uninterruptedly throughout the year.

The mean relative humidity is extremely low. San Antonio partly partakes of the humidity of the Gulf section, and it shows over all months an average rate of 81 for the 8 a. m. observation and 54 for the evening record, giving 67.5 as the daily mean. The moisture content at El Paso is much lower, 54 during the morning and but 26 for the 8 p. m. observation, the mean average being but 40. Certain sections of western Texas and New Mexico would probably exhibit figures much lower than these.

There are but few rainy days, precipitation occurring as showers of short duration, but even these are rare. The average rainfall at San Antonio is 26 inches, at El Paso 9 inches, at Albuquerque but 8. Over the plains of western Texas the annual precipitation varies from 15 to 20 inches, the mountainous regions, on account of the snowfall, being slightly in excess of this. Seventy-five per cent of the precipitation occurs during the summer months.

The winds are occasionally objectionable. Boisterous winds, often accompanied by clouds of dust, are apt to prevail during

February and March, but then this is true of almost all climates at this season. Outside of this period the air is at all times clear, although as the cities increase in size some tendency toward the smoke nuisance is observed.

In general, then, the climate of this region—and by climate we refer not alone to prevailing meteorological conditions, the aggregate of which go to make up the state of the weather, but to altitude as well—is one of great uniformity, excelled perhaps by no other sections of the country, except possibly Florida and southern California. It is an arid region with a remarkably low relative humidity, the very maximum amount of sunshine, and the invigorating influences afforded by a moderate altitude. Outdoor life is possible the greater portion of the year with the least amount of discomfort, and the debilitating effects of the summer's heat can be easily avoided by short journeys to less oppressive centers.

Sources of Information.

It is to be regretted that in neither of the States covered does any accurate system of registration of deaths prevail. The last biennial report of the Texas State board of health recorded the deaths of 56,421 persons for the period September 1, 1910, to August 31, 1912. Based upon the annual death rate of the registration area of the United States for the year 1912 (13.9 per thousand) there should have been recorded 108,322 deaths during that period. In other words, approximately one-half of the people dying in this vast State, comprising a territory as large as the German Empire, are buried without any record being made of their deaths. Wonderful strides are being made by the State bureau of vital statistics, but in the thinly settled western section, the very portion to which the tuberculous migrate, the difficulties seem almost insurmountable. The standard certificate of death is used, but in only two cities, San Antonio and El Paso, was it possible to obtain any data regarding the length of residence, a most important desideratum. Information concerning birthplace, cause of death, etc., could not be secured in hundreds of cases where the certificates were filed, owing to their incompleteness.

In New Mexico conditions are worse. There is no central bureau where death returns are made and the various county records are all that are available. These are most imperfect, there seemingly being no official whose duty it is to have the returns promptly and properly made. In all of New Mexico there is but one city or district where the death rate can be accurately computed. Within the last year a terrible mining accident occurred, in which over 200 men lost their lives, but the county records absolutely fail to give any indication of such a catastrophe. The writer met a physician, one who had

been a busy practitioner for many years, and yet had never made out a birth or death certificate!

Physicians are of course largely responsible for this unfortunate condition of affairs. Not until they have a proper appreciation of the value of birth and death certificates can we hope to have an effective system of registration in any State. Undertakers are not altogether blameless, but if the interment of bodies were made dependent upon the issuance of burial permits, and these in turn upon the receipt of a certificate of death, there would be far less trouble.

It should of course be realized that there are great difficulties attending the proper recording of deaths in this western region. A large percentage of the population is of Mexican origin. The country is very sparsely settled and none of the towns are large. Hundreds die unattended by physician or priest, and bodies are often interred within short walking distance of the home by the relatives themselves.

Morbidity returns, especially with reference to the infectious diseases, should afford us far more reliable data from which to draw conclusions. It would seem that the importance of mortality statistics in health administration has after all been greatly overestimated when compared with the far greater value of morbidity data. Knowledge of the incidence of tuberculosis, typhoid fever, poliomyelitis, and other diseases is a prerequisite in public health work, for not only are the data themselves of greater value, but the general view of the situation is rendered more exact, and valuable time is saved, inasmuch as the returns are made with the development of the disease. With tuberculosis, typhoid fever, and many other infections, this is an extremely important consideration. In the first instance years may elapse from the time of development to the date of death, while in the second the two or three weeks' delay affords ample opportunity for the occurrence of an explosive outbreak.

In Texas notification of cases of tuberculosis was made obligatory by the State law of 1911, and various city ordinances also provide for the registration of cases, the board of health in at least two cities offering inducements in the way of free fumigation of houses for the reporting of this disease. In spite of this the disease is not generally notified. In Houston and Galveston less than 5 per cent of the actual number of cases is recorded. At San Antonio during 1913 there was 1 case registered to every 6 deaths occurring; at Fort Worth 1 to every 11 deaths; at El Paso 1 to every 85 deaths, while some of the cities showed none at all. As an example of successful registration we may cite New York City, where in the year just ended there were 8,601 deaths, with 22,671 new cases recorded and 31,212 carried over from the previous year, making for every death occurring 6.2 cases notified. In Cleveland registration is so perfect that over 90 per cent of all cases are recorded previous to

death. The city of El Paso during the year 1913 harbored over 4,000 consumptives, but the health authorities were informed of the presence of exactly 4 of this number. At San Antonio the figures would be almost as startling had it not been for the presence of a practitioner who conducted a sanatorium and who was quite diligent in reporting his cases. There is no town in New Mexico which requires notification except Albuquerque, where the disease among school children is reportable.

With morbidity reports utterly lacking and mortality figures of value only in the larger cities, it is apparent that whatever deductions regarding the migration of the tuberculous are made must, as far as these two States are concerned, be largely from direct personal observation. Hospital records have been gone over with care wherever available, although here, too, there was found a great lack of careful registration of admissions and diagnoses. The books of various eleemosynary and other institutions have been consulted with the idea of determining exactly how much of a burden the indigent consumptive has been, and careful observation of railroad trains for a period of weeks was followed in order to gain an adequate conception regarding the number of afflicted traveling and the conditions under which such travel is performed. Naturally the most valuable aid was received from physicians, but every aspect of the problem was discussed with those most familiar with its features.

Some discrepancies may occasionally be noticed in the figures given. These are accounted for by the fact that the sources of information varied, the original documents not always being accessible. In one city certificates were duplicated in a register, two on each page, and as there were in the 10-year period some 13,000 deaths, it is apparent how slight errors could creep in. All forms of tuberculosis are included in these figures, and as the purpose of this study was broader than the mere determination of death rates, certificates mentioning the disease were tabulated. Deaths from tuberculous pneumonia and pulmonary hemorrhage were also recorded as tuberculosis deaths, provided the individual was unmistakably a health seeker.

Causes Leading to Migration.

The causes leading to the migration of the tuberculous can be readily summarized. The great belief in the efficacy of climate, which in some instances is even considered by the laity to be specific for the disease, is the leading factor. This in part has been the result of the recommending of climatic change by physicians. The advertising of towns, cities and railroads has done much to encourage the migratory movement, and while this advertising has been abandoned to a large extent, as far as it relates to the tuberculous, its evil

effects continue. A considerable portion of those who migrate are actually sent by physicians, lodges, societies, and church organizations, although in the opinion of the writer this number is greatly overestimated. The large contingent which wanders from community to community, or is transferred thereto by various charity organizations or people is considered later in this report.

Extent of Such Travel.

In approaching the question of the extent of travel, it must be stated at the outset that there is no way of exactly estimating the number of invalids seeking climatic relief. A census is impossible, and we are forced to rely largely upon the death rates of communities, the estimated tuberculous population of given districts, actual inspection of trains over long periods of time, and such hospital and other records as are available. None of these methods is satisfactory, and consequently it is difficult to advance definite figures, and an adequate conception of the extent of such travel can be gained only by a perusal of tables given under other headings.

In spite of this, some safe conclusions may be arrived at by studying the mortality rates of the principal resort cities, as the figures and percentages relating to the dead would also apply to the living, provided the number considered were sufficiently large. In Table 1 is presented the tuberculosis death rates of the chief resort cities of the United States for the 10-year period ending in 1912.

TABLE 1.—*Death rate from tuberculosis (all forms) per 100,000 in the principal resort cities.*

	Mean.	1912	1911	1910	1909	1908	1907	1906	1905	1904	1903
Albuquerque, N. Mex..	1,404.6	1,265.7	1,206.4	1,133.1	1,231.8	1,546.8	1,562.1	1,600.9	1,609.5	1,485.1	.....
El Paso, Tex.....	788.7	595.8	651.2	816.8	745.6	868.1	780.6	887.1	858.9	894.2	.....
Asheville, N. C.....	672.9	632.5	658.5	727.8	.....	.....	.....	.....	.....	.....	.....
Colorado Springs, Colo..	607.6	574.5	589.9	571.8	535.4	626.0	647.7	707.9	.....	.....	.....
San Antonio, Tex.....	449.2	415.8	409.2	434.7	399.4	401.0	482.4	462.6	537.0	544.8	405.4
Denver, Colo.....	372.5	299.7	292.7	330.5	378.9	395.9	386.3	409.2	411.6	427.0	393.4
San Diego, Cal.....	324.1	357.5	307.7	307.2	245.9	359.5	356.3	311.4	314.3	347.8	334.3
Los Angeles, Cal.....	299.8	255.7	277.5	259.7	253.0	261.2	324.8	333.8	343.1	302.2	387.2

Several facts must be borne in mind in studying this table. In the first place there is a great unwillingness on the part of some health authorities in the Southwest to register tuberculosis deaths as such, and frequently they are recorded as being due to other causes. This same reluctance extends to families, who often enter strenuous objections to a death being registered as due to tuberculosis, and practitioners, whenever possible, are prone to give heed to the wishes of the family; hence the figures presented may be considered as representing the minimum number of deaths.

Next, it should be recalled that the majority of these resorts exhibit among their resident population a death rate from the disease far below that of eastern cities, it being doubtful if a single one could

even equal that of the registration area, 149.5, some showing almost none; therefore all of these high rates are principally due to the influx of invalids. As we shall see later 91 per cent at Albuquerque, 63 per cent at El Paso, and 52 per cent at San Antonio of these deaths were among interstate migrants, and probably the percentages at the other resorts vary to the same degree.

The population of the various cities should also be considered. Los Angeles has a relatively low rate, but it becomes evident that with its large population it really harbors more consumptives than Albuquerque with its high rate but small number of inhabitants. The size of the community must necessarily be considered, then, in estimating the tuberculous migrants. Of the cities given, it is seen that Albuquerque with its mean rate of 1,404.6 is the highest, almost double that of its nearest competitor, El Paso, and over nine times the death rate from tuberculosis of the registration area, while San Antonio ranks fifth.

The mortality rates for the smaller towns of western Texas and New Mexico are not available, except as they have been gathered by the writer, and in no case are they deemed accurate enough to present. Eliminating the Mexican population, it is believed that the majority of the villages will show as great a percentage of interstate migrants as the cities mentioned, and it is extremely probable that the ratio of sick to well exceeds that of any similar district, with the possible exception of Arizona.

In attempting to ascertain the number of invalids actually traveling, trains were inspected throughout the two States for a period of several months. Inquiries were made of trainmen and railroad officials, but naturally this method, while giving one a fair idea of the scope of the problem, failed to bring forth figures which could be used in measuring its extent. It was, however, of considerable assistance in estimating the number of bed cases and those far advanced in the disease, but was of little value otherwise, as the majority of patients remained undetected. As an example, on a train coming East from Denver there were six people occupying a Pullman, all of whom were apparently well, but the intimacy which results from a somewhat tiresome trip disclosed the fact that three were tuberculous.

It would be expected that the transcontinental trains passing through the resorts would show the largest number of invalids, but the local traffic is really heavier in the number infected, although the former transport the greater percentage of far advanced cases. The vast majority of cars passing through western Texas and New Mexico carry consumptives at some stage of their journey. The greatest number, about 50 per cent, are in day coaches, 30 per cent occupy tourist sleepers, and 20 per cent are in standard Pullmans,

the occasional critical patient in baggage cars not being considered. Consumptives, like all other people more or less hopelessly ill are, as a rule, dissatisfied and poorly contented, hence many of them even after their arrival in a favorable climate wander from place to place in search of better conditions. This, together with the fact that much of the population of the Southwest is made up of the invalid class, accounts for the local traffic being heavier.

There is a decided seasonal prevalence in the migratory wave, the crest of the western movement being in October and November, that of the eastern in May, the hot summer months showing the least travel.

In measuring further the extent of such travel we will derive some information from the birthplace as recorded upon death certificates. While this method is not altogether reliable it serves as the only means of tracing a small part of those who migrate. It must be remembered that there is an enormous interstate migration of the well, all of the States west of the Mississippi, with the exception of Louisiana, Utah, Iowa, and Missouri, gaining by this migration, while the great majority of those east of the Mississippi are losing. Approximately one quarter of all residents of Texas, taking the State at large, were born in other States, but the newly settled western section shows a much higher percentage. It is therefore seen that the birthplace is not a clear indication of the place of origin of the invalid, the resort sections not being credited with that portion who were well when they migrated, but subsequently developed the disease. However, as we shall see later, this number is extremely small, the error being negligible in New Mexico and in favor of the resort, while in Texas the discrepancy is greater owing to the large number who have come from the eastern, southern, and northern sections of the State where indigenous tuberculosis is common.

In Table 2 are presented the tuberculosis deaths of the city of Albuquerque for the 10-year period ending in 1912, with the place of origin of each individual.

TABLE 2.—*Albuquerque, N. Mex.—Number of deaths for 10-year period, showing birthplace of each.*

Year.	Tuberculosis deaths.	New Mexico.	Other States.	Mexico.	Foreign.	Unknown.
1904	122	11	82	1	7	21
1905	140	10	92	1	15	22
1906	147	13	96	0	12	26
1907	151	5	116	0	12	18
1908	157	12	114	2	12	17
1909	131	11	91	2	13	14
1910	126	16	83	1	11	15
1911	140	9	101	2	15	13
1912	153	11	109	5	15	13
1913	152	13	116	2	14	7
	1,419	111	1,000	16	126	166
Per cent		7.8	70.4	1.1	8.9	11.7

As will be seen from a study of this table, but 7.8 per cent of all tuberculosis deaths in Albuquerque were of people born in New Mexico. There were 70.4 per cent born in other States, 1.1 per cent of Mexican birth, 8.9 per cent additional of foreign birth, and 11.7 per cent where the origin was unknown. The greater part of the foreign born, other than the Mexicans, should of course be credited to other States, inasmuch as they migrated in the same manner as the residents of those States, there being so few who come to the resorts directly from foreign countries, with the possible exception of Canada, as to be inconsequential. The three classes, those born in other States, those of foreign birth, and the greater share of those whose origin was unknown, are unquestionably interstate migrants, and they comprise 91 per cent of the total number. There is no reason to doubt that this percentage would hold true among the living of that particular section, nine out of every ten consumptives originating outside the State.

In Table 3 similar data relating to the city of El Paso are presented, but, as will be noticed, the percentages are somewhat different.

TABLE 3.—*El Paso, Tex.—Number of deaths for 10-year period, showing birthplace of each.*

Year.	Tuberculosis deaths.	Texas.	Other States.	Mexico.	Foreign.	Unknown.
1904	222	21	132	35	22	12
1905	232	18	124	42	19	29
1906	259	25	139	54	22	19
1907	259	35	132	55	23	14
1908	307	30	143	94	26	14
1909	280	29	155	62	21	13
1910	325	45	140	102	18	20
1911	284	33	134	71	24	22
1912	282	44	125	74	23	16
1913	341	59	149	93	14	26
	2,791	339	1,373	682	212	185
Per cent		12.1	49.2	24.4	7.6	6.6

Those born in Texas comprise 12.1 per cent of the whole, the eastern and southern sections of the State furnishing the largest proportion. The Mexican born make up 24.4 per cent. Those which should be credited to other States are the 49.2 per cent born there, the 7.6 per cent of foreign birth, and the greater part of the 6.6 per cent of unknown origin, making a total of 63.4 per cent who are interstate migrants, a decided falling off from the Albuquerque figures, due principally to the large numbers of those of Mexican birth.

The figures for San Antonio are if anything more interesting, and they strongly refute the statements made that nine out of every ten consumptives are from other States, at least as far as that particular locality is concerned.

TABLE 4.—*San Antonio, Tex.—Number of deaths for 10-year period, showing birthplace of each.*

Year.	Tuberculosis deaths.	Texas.	Other States.	Mexico.	Foreign.	Unknown
1904	397	114	178	47	38	20
1905	421	109	177	57	59	19
1906	357	104	150	42	37	24
1907	428	122	193	48	45	20
1908	383	125	156	49	36	17
1909	376	145	133	45	39	14
1910	442	162	158	65	49	8
1911	444	157	141	91	31	24
1912	479	177	164	79	42	17
1913	453	176	146	81	35	15
	4,180	1,391	1,596	604	411	178
Per cent		33.3	38.2	14.4	9.8	4.2

An extremely large percentage (33.3 per cent) are Texan in origin, and 14.4 per cent of Mexican birth. Crediting the interstate migrant class with those born in other States (38.2 per cent), those of foreign birth (9.8 per cent), and those of unknown origin (4.2 per cent), we have but 52.2 per cent of the consumptives dying in this city who came from other States. In other words, those originating in Texas and Mexico almost equal those who are health seekers from other States.

At San Angelo, a third resort in Texas, the percentage of native Texans is even higher (42.5). There were 40.6 per cent born in other States, which together with those whose origin was unknown (10.5 per cent), and those of foreign birth (1.8 per cent), gives a total of 52.9 per cent who were interstate migrants.

Summarizing, then, the statistics of the four resorts, we have at Albuquerque 91 per cent of all consumptives originating in other States—for these figures likewise apply to the living—63.4 per cent at El Paso, 52.2 per cent at San Antonio, and 52.9 per cent at San Angelo, these percentages including all those of unknown origin. It would therefore seem that the tuberculosis problem, as far as the three latter cities are concerned, is an interstate problem only to the extent indicated by the above percentages.

Referring to Table 1, we find that Albuquerque has a mean death rate from tuberculosis of 1,404.6 per 100,000, El Paso 788.7, and San Antonio 449.2. Using the percentages which we have just found as a basis, we can assume that 91 per cent of 1,404.6 deaths per 100,000 represents the interstate migrants at Albuquerque, 63.4 per cent of 788.7 at El Paso, and 52.2 per cent of 449.2 at San Antonio. Computing these we learn that the death rate among tuberculous invalids from other States is 1,278.1 at Albuquerque, 500 at El Paso, and 234.4 at San Antonio. In proportion to the population, those in the first city outnumber those in the last over five to one. If these percentages apply to the living, and there is no

reason to doubt that they do, the seriousness of the problem is much the greatest in the first-named city.

One other method of ascertaining the origin of the migratory class is available. The destination to other States of bodies dead of tuberculosis is deemed even clearer proof than that of birthplace. For this reason a table has been prepared from data gathered in various parts of western Texas showing to which States bodies were consigned, and while the total number, 1,775, were not altogether those who returned to their homes in this unsatisfactory manner, the majority were. So far as this particular section is concerned the list is believed to be representative. Native residents of the State are omitted.

TABLE 5a.—*Destination of bodies dead of tuberculosis shipped to States outside of Texas.*

State.	Number.	State.	Number.	State.	Number.
Illinois	225	Wisconsin	52	West Virginia	10
Missouri	217	Georgia	49	New Mexico	10
Ohio	131	Michigan	43	District of Columbia	9
Kentucky	93	Minnesota	35	Maine	8
Tennessee	92	Oklahoma	31	Maryland	7
New York	87	Virginia	28	Washington	4
Mississippi	81	North Carolina	15	South Dakota	4
Arkansas	78	California	13	Rhode Island	4
Louisiana	74	Florida	12	Arizona	2
Indiana	69	Massachusetts	14	Vermont	2
Alabama	59	Connecticut	11	Montana	1
Pennsylvania	59	Nebraska	13	North Dakota	1
Iowa	57	New Jersey	13		
Kansas	52	South Carolina	10	Total	1,775

From the above it is seen that Illinois, Missouri, and Ohio account for 32 per cent of the total number, and with Kentucky, Tennessee, and New York nearly 48 per cent; that is, approximately one-half of those who migrate into western Texas come from these six States. This does not indicate that tuberculosis is more prevalent in those States, but the circumstance can largely be explained on the ground of accessibility. Missouri and Massachusetts are nearly equal in population, and the one should furnish as many tuberculous migrants as the other, but 15 times the number go into western Texas from the first State than from the second. Just as in the early days of the settlement of the country the migratory waves followed certain definite lines, so with the ill, who apparently have particular regions where relief is sought.

The Number of Interstate Migrants.

To arrive at the actual number of consumptives resident in any particular section, and thus be able to draw conclusions regarding those who have migrated, is a difficult task, but fortunately we again have the death rate as a guide, the ratio of deaths to the number of existing cases having been pretty definitely determined. In New

York City during 1913 there were 6.2 cases registered to every death occurring. The ratio of deaths to cases as given by most authorities is 1:7, but even in nonresort cities this is much too low, unless persons with a low racial immunity go to make up the population, some authorities placing it as high as 1:10. Should we consider this the prevailing ratio at any open resort, however, we would, for several reasons, be making a serious error. First, the number actually remaining at the resorts when their condition is hopeless is relatively small, they preferring to be with their relatives at home. Second, the various sanatoria almost invariably return to their places of residence the far advanced cases, being desirous of avoiding the depressing influences of deaths in their midst, and this also has become the general custom among physicians. Third, it has been found by relief societies that it is much cheaper, as well as more satisfactory to the afflicted, to make a similar disposition of the hopelessly ill, as they invariably require care and nursing in the later stages of the disease. All this serves to decrease the death rate and incidentally to increase the number of far-advanced cases transported. For these reasons, then, the ratio of 1:10 does not hold good, and some other standard must be fixed.

The index decided upon by the writer is 1:15, a purely arbitrary figure. This ratio was accepted, however, only after careful consideration, the interviewing of many physicians, the examination of death records in every town visited, and averaging the estimated tuberculous population as advanced by well-informed persons. For our use, then, we shall consider the number of consumptives resident in a given resort city in any particular year as 15 times the number of deaths for the disease during that period.

At Albuquerque for the year 1913 there were 152 deaths from tuberculosis, 138—or 91 per cent—of which were of the interstate migratory class. Multiplying this by our factor, 15, we have 2,074 as the tuberculous population of the city who have at some time come from other States. At El Paso the deaths were 341, the percentage was 63.4 and the ratio 15, 3,243 being the migratory consumptives. At San Antonio the deaths were 453, the percentage much lower, only 52.2, and the factor 15, giving 3,547.

Below is presented a table, prepared after this manner, of the tuberculous population of the three cities for the 10-year period, omitting the Mexicans and those born within the confines of the State; in other words, the noninterstate migratory class. The percentages used are the same as those given above, as they are the averages for the 10-year period, but those for each of the individual years could have been taken instead, although the method adopted is considered the better of the two. The only variable factor is again

our ratio of deaths to the number afflicted; some will deem it too high, but it is believed to be a safe average. It is to be borne in mind that these figures do not represent the total tuberculous population, but only those who have at some time migrated from other States.

TABLE 6.—*Tuberculous interstate migrants in three cities.*

Year.	Albuquerque.	El Paso.	San Antonio.	Year.	Albuquerque.	El Paso.	San Antonio.
1904	1,665	2,111	3,108	1909	1,788	2,662	2,944
1905	1,911	2,206	3,297	1910	1,719	3,090	3,460
1906	2,005	2,463	2,795	1911	1,911	2,701	3,476
1907	2,061	2,463	3,351	1912	2,088	2,682	3,750
1908	2,142	2,919	2,999	1913	2,074	3,243	3,547

These are the figures for but three cities. When it is realized that innumerable smaller towns scattered throughout this western country have relatively a much larger tuberculous population, some idea of the large number who have flocked to that region may be gathered. Some one has stated that this section is but a vast sanatorium, a refuge for the afflicted, and whoever has an extensive acquaintance in that territory will corroborate this testimony. The populations of such towns as Kerrville, Comfort, Boerne, Alpine, and San Angelo, in Texas, are largely made up of health seekers, and it is a safe statement to make that 50 per cent of the inhabitants are there, or came originally, for the health of some member of the family. In western Texas alone there are probably 30,000 consumptives. Not all of these, however, are in an active stage of the disease, some having made complete recoveries.

In the majority of New Mexican towns, outside of the mining settlements, from 20 to 60 per cent of the families have had some member who was tuberculous, barring of course the Mexican population, but in Silver City the percentage will run as high as 80. Socorro, Las Vegas, Raton, Las Cruces, and many other smaller towns are largely composed of health seekers, and the ratio of sick to well is greater even than in Texas. The total number of consumptives in New Mexico is of course unknown, but granting that the ratio for the entire State is half that of the city of Albuquerque, there would be over 27,000. The National Association for the Study of Tuberculosis estimates that 10 per cent of the residents of the arid region are, or have some member of the family who is, tuberculous, and that annually 10,000 consumptives who are hopelessly diseased go West to die. There is not the slightest reason to doubt either of these statements.

The question arises whether the number of migrating invalids is decreasing, the general impression being that it is. Several explanations of this impression may be offered, the chief one being that the

far-advanced cases, the ones generally recognized, are less evident. With the increase of population the ratio of sick to well has fallen, although the actual number of invalids may have increased. The establishment of large State institutions in the East, and the better education of physicians and public, would also lead one to expect that some diminution had occurred.

Referring to Table 1 we find that the death rate per 100,000 for the several resorts is without exception diminishing, but it should be borne in mind that each of the cities cited has had a phenomenal increase in population during the last decade, and it is quite improbable that the total number of invalid migrants should have kept pace with this growth. San Antonio has increased from 71,000 to 110,000, but with such a rapid growth the city shows but little decrease in its tuberculosis death rate. El Paso during the 10-year period has practically doubled its inhabitants, and this explains the diminishing rate in that city. Bearing these facts in mind we must conclude that so far as the death rate indicates the proportion of sick to well shows a diminution, but that the actual number of cases migrating is increasing, and this in spite of the dissemination of information regarding the curability of the disease in other climates and the erection of large institutions for its treatment in the East.

Reference to Table 6 will serve, as far as these three cities are concerned, to further substantiate this statement. Albuquerque, San Antonio, and El Paso each exhibits an increase in its interstate migratory consumptives. When it is considered that these figures are based upon the mortality returns, and that as we shall later see the number of far advanced cases being sent to the West is decreasing, it becomes all the more apparent that the actual total of tuberculous migrants is increasing rather then diminishing.

Stage of the Disease During which Travel is Performed.

It is conceded that from a public health standpoint the far-advanced consumptive is, owing to cough and expectoration, of more danger than the incipient case. This is only true, however, if each is careless to the same extent, but a given far-advanced case may be, and often is, the safer of the two, as he may have had far better opportunity of learning how to care for himself as well as for others. The recognized invalid is the one chiefly feared, on the principle that what we do not know about we worry over but little. Few people seriously object to occupying a car with half a dozen early consumptives who present but little appearance of invalidism, but complain at once should a bed case appear.

As descriptive of the stages of the disease under which some of the travel is performed the following cases may be cited:

On a California train bound for Chicago was a boy of 19 accompanied by his mother. He had been at a town in northern Arizona,

had rapidly become worse, and the attending physician, realizing the lad's most serious condition, had informed the mother that it was hopeless to expect to get him to his home. But the mother yielded to the boy's importunities, and decided that his dying wish should be gratified. He was placed in a compartment and began the slow trip eastward. Fortunately there was a physician on board who rendered every possible aid, but the united efforts of mother and doctor were without avail and the boy expired still longing for a glimpse of his old home. On February 2 at El Paso a patient, friendless, unattended, and too poor to afford a berth in the sleeper, was being transferred from one train to another by the railroad attendants when he collapsed and died in his chair. In December a tuberculous invalid en route to San Antonio died in a drawing room of a Pullman when within a few miles of his destination. Numerous instances of this character could be cited from the records of every railway center. In the year 1912, on trains running into Albuquerque alone there occurred five deaths from tuberculosis, and since 1904 there has been an average of two a year. These facts are indubitable proof that the advanced cases that travel are still far too numerous.

While the actual number of far-advanced consumptives seeking climatic relief is undoubtedly decreasing, several circumstances tend to maintain or increase the number who are traveling. The majority of private practitioners when called to a hopeless case frankly advise, unless the conditions for his care are altogether satisfactory, the return of the patient to his home. Sanatoria are reluctant to have deaths occur within their midst; consequently all far-advanced cases are, if possible, transferred to their place of origin while yet able to travel. Charity organizations and city and county authorities much prefer to furnish transportation rather than quarters and care, and relief societies have found that it is much cheaper in the end to provide tickets, even to far eastern points, to patients who have no chance of recovery than to care for them during their last days and to provide burial at the end. These circumstances tend to favor the transportation of people in the last stages of the disease, and bed cases, or those which should be bed cases, are so common on trains running to and from the resort cities as to excite no comment among railway employees.

The following tables, based upon the length of residence previous to death of those dying in Albuquerque, San Antonio, and El Paso during the last 10 years, will give some idea of the number of hopeless invalids carried, and at the same time inform us as to the utter uselessness of far-advanced cases seeking climatic benefit. It should be remembered that these figures represent only a few of those who have traveled in one direction, the large number who have migrated and then returned to their homes in a critical condition not being

mentioned. The figures refer to length of residence in the city and not in the State, and they include all classes.

TABLE 7.—*City of Albuquerque—Length of residence in the city of those dying of tuberculosis.*

Year.	Tuberculosis deaths.	Under 30 days.	30 days to 6 months.	6 to 12 months.	1 to 2 years.	2 to 5 years.	5 to 10 years.	10 to 15 years.	15 to 20 years.	Over 20 years.	Unknown.
1904	122	17	41	14	12	16	3	1	1	1	16
1905	140	29	42	11	12	20	14	1	.....	2	9
1906	147	22	48	16	17	14	4	5	3	7	11
1907	151	32	46	23	11	21	4	1	1	2	10
1908	157	20	53	22	6	24	9	3	2	8	10
1909	131	18	45	11	10	17	18	1	1	7	3
1910	126	17	33	10	9	23	12	3	7	4	8
1911	140	26	42	15	10	22	5	3	2	4	11
1912	153	23	50	18	7	24	18	.....	1	4	8
1913	152	18	39	20	17	12	14	6	3	8	15
	1,419	222	439	160	111	193	101	24	21	47	101
Per cent	.....	15.6	30.9	11.3	7.8	13.60	7.1	1.7	1.5	3.3	7.1

Consulting Table 7, we find that of the deaths in Albuquerque during the last 10 years 15.6 per cent occurred within 30 days after arrival. This is a high percentage and plainly shows that many were in a dying condition when they went there, some, in fact, expiring in the station and others but a few hours after reaching the city. Besides these, 30.9 per cent of those dying lived less than six months after arrival, giving us a total of 46.5 per cent of deaths occurring within the first six months. Surely we can arrive at no other conclusion than that these cases, barring those that developed miliary tuberculosis, meningeal or other severe complications, were all too ill to have ventured forth when they stepped on the train. The percentage of those recorded as having lived from 6 to 12 months in the city was 11.3 per cent; thus 57.8 per cent of all these deaths took place within one year of arrival.

The figures for El Paso are fully as instructive and demonstrate that the railroads are forced to carry as many dying patients in that section as farther north.

TABLE 8.—*City of El Paso—Length of residence in the city of those dying of tuberculosis.*

Year.	Tuberculosis deaths.	Under 30 days.	30 days to 6 months.	6 to 12 months.	1 to 2 years.	2 to 5 years.	5 to 10 years.	10 to 15 years.	15 to 20 years.	Over 20 years.	Unknown.
1904	222	44	66	23	21	27	10	14	4	5	8
1905	232	35	67	15	16	31	23	9	4	9	23
1906	259	45	57	21	23	27	28	12	11	11	24
1907	259	37	54	34	28	30	23	10	7	16	20
1908	307	40	63	26	32	43	43	19	17	13	6
1909	280	34	62	21	22	48	36	15	12	18	12
1910	325	30	33	19	15	28	35	12	12	13	128
1911	284	22	45	20	15	37	31	18	11	17	68
1912	282	12	43	26	21	25	32	22	13	12	76
1913	341	22	41	26	27	34	27	26	15	15	108
	2,791	321	531	231	220	335	288	157	106	129	473
Per cent	.....	11.5	19	8.3	7.9	12	10.3	5.6	3.8	4.6	16.9

For the 10-year period 11.5 per cent of all fatal cases died within 30 days after arrival; 19 per cent in addition lasted less than 6 months, making a total of 30.5 per cent. This is a much better showing than that of the previously named city, the reason being the much larger percentage of cases in which the length of residence in the city was unknown, and also because the Mexican population, who have a much longer length of residence, is considered. Eliminating this class, it is found that 18 per cent of the deaths occurred within 30 days after arrival, and an additional percentage of 28.7 within 6 months, this covering a period of 6 years. As far as the migrants are concerned, therefore, the two cities exhibit practically identical figures, 46.5 per cent in Albuquerque, and 46.7 per cent in El Paso of all deaths resulting before a residence of 6 months is completed.

The figures for San Antonio during the 10-year period are given in Table 9, the percentage of deaths under 6 months after arrival being 32.7 per cent, the 30-day cases not being available and the Mexicans being included in the computation. Without the latter the percentage would be as high as either of the two previously named cities. Even this figure is far above that which the California commission found in the southern section of that State—17 per cent.

TABLE 9.—*Length of residence at San Antonio.*

Year.	Tuberculosis deaths.	Under 6 months.	6 to 12 months.	1 to 2 years.	2 to 5 years.	5 to 10 years.	10 to 15 years.	15 to 20 years.	Over 20 years.	Unknown.
1904	397	170	28	20	32	23	24	23	58	19
1905	421	158	32	22	40	35	26	17	51	40
1906	357	138	32	22	39	34	13	20	42	17
1907	428	181	30	28	31	38	21	21	49	29
1908	383	133	32	20	48	40	21	25	43	21
1909	376	125	20	31	34	31	30	16	55	34
1910	442	129	32	36	61	32	32	14	76	30
1911	444	105	32	36	63	36	32	28	72	40
1912	479	114	36	43	61	44	23	33	83	42
1913	453	113	22	23	45	44	22	18	67	99
	4,180	1,366	296	281	454	357	244	215	596	371
Per cent	.....	32.7	7.1	6.7	10.9	8.5	5.8	5.1	14.2	8.9

A case of tuberculosis dying within 30 days after arrival, unless such death be due to sudden and unforeseen complications, ought never to have been sent to any resort. And yet at Albuquerque there were 222 cases of this character, and at El Paso 321 in the 10-year period, this not taking into account the far greater number whose condition was critical and who were immediately returned. When nearly one-sixth of those dying expire within 30 days after reaching their destination no one need tell us that some one has grievously erred in sending such patients forth.

Among physicians practising in the resort cities it is the consensus of opinion that it is far better for every patient whose expectation

of life is less than six months not to seek climatic change, unless of course it can be obtained with every degree of comfort—the hardships imposed, the annoyances and sufferings, and the absence from friends and relatives in the last days of one's existence but merely hastening the end. It is not always possible, even for physicians, to indicate patients in whom a fatal termination may be expected within this period, but with a reasonable degree of care many cases of this character could be eliminated. At Albuquerque the average annual mortality among invalids of this class is 55, at El Paso 71, and at San Antonio 114, to say nothing of the many hundreds who are returned to their homes. The majority of these were of course too far advanced to receive more than the slightest benefit, and it is to be feared that the change in numerous instances only hastened the end.

Physicians who are interested in the climatic treatment of tuberculosis may claim that these tables are altogether misleading, in that they take no account of the vast number who visit the resorts and improve or recover. This is true. They were not compiled with that intention in view, there being no means other than institutional statistics for furnishing that information. The data given is merely to prove that the number of far advanced cases of tuberculosis that are passengers upon interstate trains is exceedingly large.

The question immediately arises whether the number of hopelessly ill traveling to and from the resorts is increasing or diminishing. We have seen that the actual number of invalids is almost without exception increasing, although less rapidly than the population of the resort cities, but with the far advanced cases it is a different matter.

The agitation against sending far advanced consumptives to western resorts culminated in 1907 and 1908 when extensive press notices decried the injury done in transporting patients dangerously ill these long distances. Previous to that time the medical press had repeatedly called the attention of the profession to the utter futility of the practice and the great injustice to the traveling public, as well as to the patients themselves.

The accompanying charts have been prepared with the idea of showing what benefit has been derived from the wide publicity given the subject. Chart 1 shows the length of residence of those dying at Albuquerque in the ten-year period ending 1913, the dotted line indicating the percentage of those who died having lived less than 30 days after arrival, the remaining line those who lived less than six months after reaching their destination. It will be seen that in 1907 and 1908 both lines descended to a slight extent, but as far as this one city is concerned the agitation apparently resulted in very little benefit. The chart relating to El Paso tells a different story. Both

the 30 day and 6 months' cases have decreased by half, and the figures at San Antonio, which have been worked out but are not presented, show a like diminution.

Methods in Use on Cars for the Protection of the Traveling Public.

The necessity for the sanitation of railway coaches has probably been apparent to every enlightened traveler, and the subject is one which at present is receiving far more attention, not alone from those interested in public health work, but from the railroads themselves, than in years past.

So far as travel in our own country is concerned there are really four classes of accommodations, the compartment and drawing room sections of Pullmans, the standard Pullman, the tourist car, and the day coach or chair car. The Pullmans, including the tourists, are as a rule on much longer runs, but invariably have an official other than a trainman in charge, and are under one management; the day coaches are on shorter runs, are not as closely supervised, and are cared for by the individual roads. The sanitation at terminals, and the precautions observed while in transit, differ materially, not only in the same State but of cars running over the same roadbed.

Pullman coaches.—Pullmans, and by Pullmans we shall hereafter include tourist cars, are fumigated at varying intervals. Texas has legislated in this matter, requiring fumigation twice every seven days, but on certain routes specified by the president of the State board of health, only once in seven days, and Oklahoma and Louisiana once a month. New Mexico is without regulations requiring disinfection. Every attempt is made by the Pullman Co. to comply with the laws of the respective States, and it even goes further and fumigates cars on certain runs oftener than the law compels, and on any line when sickness is reported. All conductors and porters have specific instructions regarding the reporting of illness. In the opinion of the writer, these instructions are complied with, to the extent that bed cases, and in some instances those that are about, are reported as ill.

The permanganate-formalin process is used and the method is the same at practically all terminals. The windows and the ventilators are closed. All berths are lowered, and the bedding, except the linen, which has been previously removed, is exposed, the curtains being hung in their accustomed place. Three containers are used, the permanganate and formalin being given to the fumigator in measured quantities. Exposure is usually for three hours, but at some terminals only two hours are deemed necessary. In each car a fumigating record is kept, with the date of treatment, the duration, and the signature of the workman or foreman. Examination of these records

in a large number of coaches shows in most instances more fumigations than the law requires.

For the most part the work is performed by untrained men who have no knowledge of why they are doing it; hence it is often carelessly done. The writer has repeatedly observed fumigation proceding with both toilet ventilators, apertures 6 inches in diameter, wide open, and he has yet to find a fumigator painstaking enough to close the bell-cord holes at either end of the car. Pullmans when compared with ships and ordinary dwellings, are much easier to

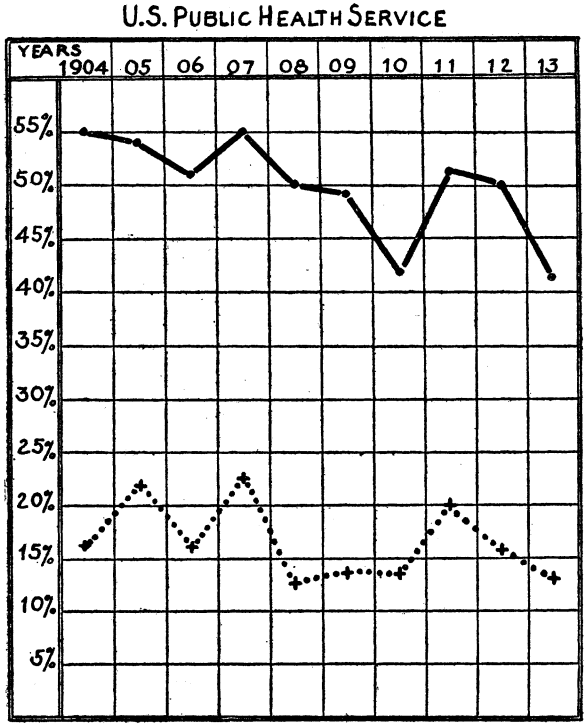

Chart 1.—City of Albuquerque. The dotted line indicates the percentage of deaths occurring within thirty days after arrival, the black line those within six months. Note that the decrease in the number of cases dying within thirty days after arrival has been slight.

treat, as they are fitted with double windows, have fewer openings, and are altogether tighter; therefore the process, except the preparation of the bedding, is rapid, simple, and inexpensive. An exposure of three hours is under ordinary conditions, sufficient, but in the Southwest where the humidity is extremely low, a longer time should be given. Complaints are occasionally entered by passengers of the irritation from the formaldehyde, but this is most apt to occur on damp, still days when the car has not been aired for a sufficient period or goes into service within a few hours of fumigation; frequently the cause of this is the evaporation of formalin used in the cuspidors by

the heat from steam pipes. The efficiency of the fumigation, then, can be said to be in direct proportion to the intelligence and care of the man performing it, perhaps averaging fairly well with that of some health authorities.

Following the fumigation of the car, "stripping," which consists in the removal of mattresses and bedding, carpets, and the removable portion of the seats, is in order. "Stripping" is usually done as often as once a week, weather and other factors permitting. The ideal

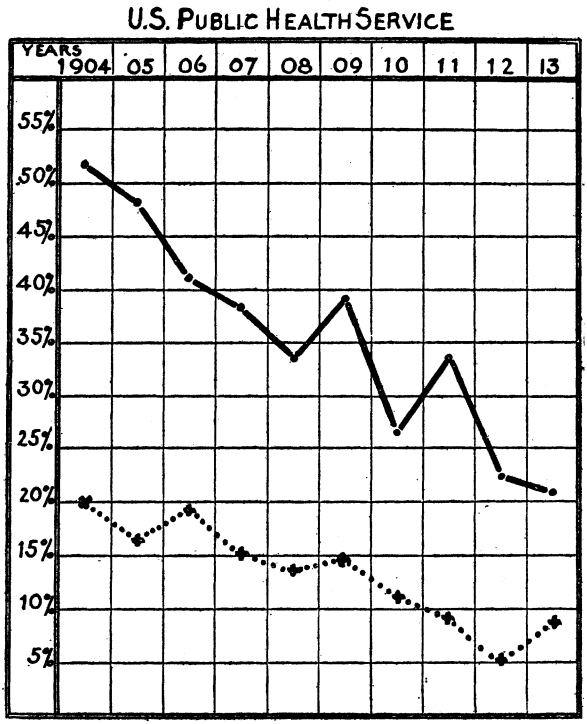

Chart 2.—City of El Paso. The dotted line indicates the percentage of deaths occurring within thirty days after arrival, the black line those within six months. Note that the number of cases dying within thirty days after arrival is steadily decreasing.

method for the further treatment of the car is by the use of compressed air.

All windows, ventilators, and doors are opened. Air is delivered to a workman through a hose from a central station under a pressure of from 60 to 90 pounds. Various forms of nozzles are used, depending upon the character of the work. The operator should invariably wear a respirator and the number of hours of employment should be limited, for at the best it is a dangerous and debilitating occupation. Beginning at one end of the car, reaching back of berths, behind steam pipes, and into other recesses, the "blowing," as it is termed, proceeds, the dust being disseminated through doors and windows.

Not less than three-quarters of an hour should be devoted to each car in order to accomplish thorough work.

Theoretically the vacuum process, which picks up rather than disseminates the dust, should afford better results than compressed air, but practically it does not. No vacuum system has yet been devised which will reach into the numerous recesses of a car and withdraw dust and dirt, and on bare floors its use is also attended with difficulties, but with carpets, cushions, and like surfaces it works satisfactorily. The other advantage of compressed air is its availability in many railroad yards.

In many important railway centers neither the pressure nor vacuum process is in use. In some yards there are no compressors, in others the air is not piped a sufficient distance, and other reasons prevent its universal adoption. San Antonio, a city where it is highly important that coaches should be as thoroughly cleaned as we know how to do it, has no such system, and numerous other cities could be cited.

The removable portion of the upholstery and bedding is treated outside the car. Blankets are suspended or laid upon racks and gone over carefully with air until the current penetrates dustless, mattresses being afforded the same treatment

Where "blowing" is impossible, the old hand method of beating is in use, a tiresome, expensive, and never satisfactory process. Carpets are quickly cleaned by air if available; otherwise they are beaten. All curtains are gone over, the spots found being sponged with a weak formalin solution and then with soap and water.

Vermin, in the writer's experience, is unusual in Pullman cars, but with the bringing in of so much baggage some danger of infestation arises. In the majority of districts, therefore, cars are treated with an efficient antivermin preparation twice a month; in other places less often. All seats are brushed over carefully with the liquid, the edge of the upholstery being raised if necessary, and the recesses of berths are similarly covered. Whenever vermin appear in any number it is conclusive evidence that some part of the cleansing process has been shirked. Tourist and buffet cars, where food is more frequent, may harbor roaches.

Cuspidors at the commencement of a trip contain a small amount of 5 per cent solution of formalin, and an additional supply is carried in every car for this purpose. It is seldom used and a dry cuspidor is the rule after the first day's run. At terminals the cuspidors are washed, the washings usually being dumped down the hopper. They are then polished, the cleaning process being done in the smoking room. In some districts they are sterilized by live steam, a desirable method. The use of a smooth surfaced cuspidor is also advantageous.

Instructions regarding the treatment of water containers are very specific, complying with the requirements of the Interstate Quarantine Regulations, which provide that they "shall be cleaned and thoroughly scalded with live steam at least once in each week that they are in operation." The date of the steaming is usually chalked up on the containers. The instructions also state that the hand shall never be placed in the container after it is steamed, and that the covers should always fit tightly. All new cars and those going to the shops for repairs, are equipped with separate ice and water tanks, a decided advantage. The same regulations also require certification as to the character of the water and ice used.

Toilets are cared for by washing, preferably with kerosene to remove the discolorations from soot, or with soap and water, and then gone over with a 5 per cent solution of formalin. The further cleansing of the car consists in the use of soap and water wherever necessary, the woodwork being rubbed down, brass polished, and windows cared for. Practically all the work is done in the open air where there is a constant supply of the best disinfectant, sunlight.

Coaches other than Pullmans.—The methods used in the sanitation of Pullmans are, with unimportant modifications, identical throughout the country, the same inspectors checking up the work and determining whether it is thoroughly and efficiently performed. In the case of other coaches chaos reigns. There is no system, the methods are not standardized, the equipment is more apt to be poor, and hence unsanitary, and much of the cleaning is improperly done, the work usually being in charge of a yard foreman who has many other important duties. Therefore the statements made regarding the sanitation of Pullmans are in no sense applicable to day coaches.

Compressed air is used if it is available, but as the routes of day coaches are often between less important terminals it is more often lacking. Sweeping is the substitute, and its degree of thoroughness can be determined by anyone who cares to inspect the recesses beneath steam pipes and seats, dirt being caked so thick in many cars that it can be pried off with a knife. Fortunately the wooden floor is being displaced by the composition floor, which lacks the cracks and crevices. Carpets are treated with compressed air outside the car; otherwise they are beaten, and cushions are similarly exposed. The floors are mopped with a weak solution of some antiseptic, usually one of the carbolic preparations.

Contents of cuspidors are dumped in the most convenient place, oftentimes down the hopper, but in some yards receptacles are provided. As they often contain banana peelings, orange skins, and other refuse this material becomes scattered indiscriminately about the yards. The average cuspidor in use in day coaches is highly insanitary. It is large, easily capsized, becomes the receptacle for

refuse, and, worst of all, owing to erosion, it can be only imperfectly cleaned, even by those who show any inclination to properly clean it. It therefore should be condemned from a sanitary, æsthetic, and every other standpoint. The cleaning of cuspidors is at times performed in the coaches themselves. With two pails and a stiff brush the workman goes through a car, bespattering seats—as disgusting a spectacle as one could look upon.

Water tanks are afforded the same treatment on all interstate cars. Toilets are cleaned with soap and water and then with a disinfectant solution. Basins are likewise attended to, and the woodwork is supposed to be gone over with a damp cloth. In a very limited number of cases the cleaning is as thoroughly done as that of Pullmans, but as a rule it is far inferior, although the necessity therefor is even greater.

Fumigation is seldom resorted to, but on a few roads it is performed previous to cleaning for the safety of the employees. The Texas State law does not compel the fumigation of day coaches, but does describe how they shall be cleaned, and the frequency thereof, the discrimination probably being made on account of the supposed greater danger of Pullmans.

Precautions Observed while in Transit.

Precautions observed for the protection of the public must, in most part, be accomplished at terminal stations, for after a car is in transit railroad officials are dealing with a heterogeneous mass of people whose personal habits are widely variant.

Pullman cars accept for transit all classes, the sick and the well. People who are severely ill do not purchase their own transportation and they are often brought to trains on stretchers, to be loaded into a car by way of a window. In every such instance the company urges occupancy of a drawing room or compartment, but many can ill afford this expense. Consumptives are received equally with others. Conductors have strict orders that all berths occupied by people of this class shall remain unsold and closed until the car reaches its destination. This order is undoubtedly complied with as regards bed cases, but we can not expect conductors and porters to recognize more than a very small proportion of those who are suffering from this disease. Illness of whatever nature is required to be reported to the superintendent's office, and following such reports all cars are promptly fumigated.

Few people with tuberculosis who travel exercise any precautions whatever. Beneficiaries of the three Government sanatoria are provided with pocket sputum cups, a colored 5 per cent phenol, or other disinfectant solution, and are properly instructed. Others, particularly those who have resided at sanatoria, give some thought to

their neighbors, but the vast majority of consumptives, as well as healthy persons, are careless with their sputa.

A decidedly salutary measure, advocated by the Public Health Service in 1905, and for the carrying out of which the Pullman Co. deserves great credit, is the adoption of the third sheet on all berths. Various States have seen fit to legislate regarding the length of sheets in hotels, and such legislation has often been derided as farcical. The idea is that the clean linen should protect the sleeper's face from a blanket which may have become soiled or infected, but the sleeping-car company has gone a step further and provided all beds with a third sheet which completely covers the blanket.

The introduction of the dental lavatory is a sanitary measure also recommended by the Public Health Service in 1905. As yet all cars are not so equipped. As long as Americans consider that soap is not a toilet article to be provided by the individual, liquid soap should be furnished. The abolition of the common drinking cup and common towel is a measure to which the public has become thoroughly accustomed.

The ventilation and heating of coaches certainly has a bearing on health and comfort. Most cars are miserably ventilated. Recently the introduction of such patented devices as the Garland system has done much to improve conditions, but rock ballast, oiled roadbeds, and oil-burning locomotives have also made it possible for each traveler to have a modicum of fresh air. While newer ideas have recently come into vogue concerning ventilation, no one doubts that the value of pure fresh air is as great now as it has ever been.

The overheating of cars is another abuse. Under the old system where it was impossible to shut off steam at any one point there was doubtless some excuse for this condition; now with the vapor method coming into general use temperatures should be more even. Coaches should be, and the majority are, equipped with thermometers.

The distances traveled by coaches has much to do with their sanitation. With Pullmans long runs are required, but freshly cleaned day coaches can be switched in at important terminals as substitutes for those which require attention. Many such runs are broken, and more should be. At one Texas point a coach was observed which had a run of 1,350 miles, and the only cleaning it received during that time was being performed with 30 passengers in the car, one of whom was a dying consumptive en route to California. All were inhaling the dust which rose in quantities from the floor.

There remains to be mentioned really the most important aspect of the question, that which deals with the people themselves. The ordinary traveler is filthy beyond belief. A day coach at the completion of a 600-mile run is a sorry spectacle. Bread, meat, pickles, and banana skins litter the floor, sputum is everywhere, and if one or

more cuspidors have not been upset on the journey it is the exception. The railroad company is hardly responsible for this. The coach may have been as clean as human hands could render it when it left the yards; it returns in this disreputable condition simply because the public would have it that way. No remedy for promiscuous spitting, the greatest evil, has yet been found. The mate who was accustomed to order one of his deck hands to stand by the careless spitter, and each time the deck was soiled to swab it up, came nearest to the solution of this problem of any human being. Public vehicles are only as sanitary as the public chooses to keep them, and when the people correct their habits this problem will largely solve itself.

The Dangers to Travelers and Employees.

Are railway coaches a source of infection in tuberculosis to travelers and employees? We have gained some idea of the large number of consumptives carried to and from the resorts, to which we should add the many thousands who daily mingle with the traveling public; we have seen that a large proportion are far-advanced cases, many even being bedridden, and that the precautions which should be observed are almost totally lacking. Also, that the cleaning and sanitation of one type of car, the Pullman, is standardized, being on a fairly satisfactory basis, but that all other coaches are cared for under different rules and regulations, the attention rendered the majority being imperfect. Yet with all of these facts before us an answer to the above question is difficult.

The question of methods of infection in tuberculosis is of paramount interest. Theories have been advanced again and again, each being but a step toward the scientific truth, and we have still much to learn before our knowledge of how this great scourge is passed from one generation to another is complete. Within the last few years facts have been marshaled which go a long way toward proving that our previous views, while not altogether erroneous, need modification. A brief knowledge of those views is necessary for a proper consideration of this subject.

Infection in tuberculosis results from close and perhaps prolonged association with some individual suffering from the disease. The nearness to the individual is not important, although droplet infection from forceful coughing is more apt to occur if contact is close, but the mere occupancy of a room previously used by a consumptive who has been careless in the disposal of his sputum is sufficient. Heat, poor ventilation, and lack of sunlight, increase the liability of infection, dust also acting deleteriously. Under ordinary conditions dishes are probably not responsible for the spread of the disease, but

blankets and soiled or imperfectly cleaned linen may be an important source of infection.

Childhood is the age when infection is most apt to occur. This is demonstrated fully by both the tuberculin test and post-mortem examinations. There are doubless few children under the age of 15 who have been accustomed to visit public places who remain uninfected. In its earliest stages the disease may show itself in only slight anemia, poor physical development, or other mild ailment, and primary infection does not by any means indicate that the child is to become tuberculous in his later years, other factors entering into the matter. However, the importance of childhood infection can not be overestimated, for the greater number of cases date from this early period of life, the disease having remained dormant for years.

Adults are far less susceptible to tuberculosis than was formerly supposed. That is, a healthy person can be, and often is, in close contact with the tuberculous, receiving no harmful effects, the immunization acquired in his early days protecting him in his later years. But should other infections occur, or should the individual become dibilitated through dissipation, long hours of labor, close confinement, or other causes, the dormant infection of his youth may become active; in other words, he reinfects himself from an infection which he long ago conquered.

Acceptance of these facts compels us to modify some of our ideas regarding the disease. We must go much further back than the development of ordinary symptoms to locate the infection, and we must take into consideration not one factor alone, the presence of the bacillus, but every other consideration. The problem of prevention, therefore, would seem to have become more and more complex, but in reality it is simplified. The tubercle bacillus has lost none of its dangers, for it comes from its lurking place to attack the young in a battle the destructiveness of which may not be in evidence for a generation. Our warfare against such a treacherous agent should be as unceasing and relentless as it has ever been, but not until we have captured the entrenchments, bad housing, poverty, long hours, and darkness, behind which it is battling, can we hope to succor the race. We have been throwing our forces not at the wrong point, but at a single point, when the attack should have been general all along the line.

Many of the conditions cited as predisposing to the infection and development of tuberculosis are present in railway coaches. The infective agent, the traveling consumptive, is common enough, and the soil is ready for the implantation. Fortunately, the exposure is usually of short duration, but the length of time necessary to produce infection is undetermined. Dust, insufficient ventilation, and over-

heating can have nothing but a deleterious influence even upon the well, none of these conditions actually causing tuberculosis, but all being strong predisposing factors. Next to close contact in homes in which careless consumptives are residing, the public gathering places, such as moving-picture halls, theaters, street cars, and schools, afford the best opportunity for infection, and we are therefore warranted in concluding that in the light of our present knowledge railway coaches are also at least possible sources of contamination.

To prove this contention from the mortality statistics of employees would be a difficult procedure, and even if figures were given they would, in view of our acceptance of recent knowledge regarding infection, only demonstrate that great debilitating influences were present. Railway workers are as a class a selected group, the greater portion of whom live an outdoor life, and all are necessarily temperate. Their mortality from tuberculosis should be low, even considering those who labor in a somewhat depressing environment. Porters live irregular lives, with long hours of confining duty; consequently their death rate should be high. Would it not seem then that any deductions made from the mortality records of either of these two classes would be quite apt to be erroneous?

The question arises whether the dangers from imperfect sanitation are of equal magnitude in all forms of railway coaches. For some reason, by the popular mind the sleeping car is considered the greater menace. Just why this is so it is difficult to say, but doubtless because of the bedding, curtains, plush, and other supposedly germ-catching fixtures, as all coaches are used more or less for sleeping purposes. As a matter of fact, the Pullmans are much more thoroughly cleaned, are better cared for en route, and they at least cater to a class of people whose habits are if anything less pernicious than those who are too poor to afford these comforts. The number of children they carry—and childhood is the age of infection not alone in tuberculosis, but in many other diseases as well—is inconsiderable compared with those who travel in either tourist or day coaches, a decidedly important consideration. It would seem, therefore, that we are warranted in saying that the day coach is the greater menace, the tourist car next in order, owing to the fact that it is often crowded, and the standard Pullman the least dangerous. Fortunately, smoking cars, where spitting is most promiscuous, are not frequented by children.

Measures Variously Suggested for Control of the Migration of the Tuberculous.

Numerous suggestions have been offered for the control of interstate tuberculous traffic. Some of these are visionary; others are prohibitive as to cost; many are impracticable, while still others are hardly justified.

The broadest and most comprehensive plan which has been offered is for the National Government to regulate the traffic by a system of inspection, requiring the issuance of a permit to all prospective infected interstate passengers. This arrangement is one which has been followed successfully in times of severe epidemics, such as outbreaks of yellow fever, and has proved its worth, but no fair-minded person can believe that the seriousness of the present problem justifies an extreme measure of this character. The cost of maintaining such a system would be entirely out of proportion to its value. It would require a force scattered in every large city of the United States, and while not wholly impracticable, it is altogether unnecessary. The plan, then, may be dismissed at once.

Another suggestion is for the individual States, more especially those in the resort area, to establish a quarantine at the State boundary, permitting only those consumptives to pass who are properly provided with funds and in other respects desirable. This measure, then, would be one in which each Commonwealth answered for its own welfare, regardless of its neighbor, and would serve only indirectly, namely, by diminishing the number of interstate passengers, in solving the problem. This plan has been frequently advanced, and almost every year a dispatch from some center announces that the State is seriously contemplating putting it in operation, or if not the State, then the city, but as yet none has had the courage of its convictions in the matter. As a public health measure no justification for such a severe enactment as this can be found; from a humanitarian standpoint it is to be utterly condemned, and as a bar to indigent consumptives the expense would exceed the cost of maintaining every pauper invalid in any district.

Hospital cars have been suggested as a solution of the problem—in other words the segragation during transit of all traveling consumptives. The originators would have a car, properly equipped and used for this single purpose, leave an eastern terminus at a specified date, perhaps once a week or oftener—they do not specify—gather in coughing invalids en route, and deposit them in the various resort towns after a comfortable and satisfactory journey. Just how many coaches of this character would be required no one has determined, and how they would visit the thousand and one cities of the East, and at whose expense, has also not been figured out. Who would select the invalids for this car is undecided—certainly not the ticket agent or conductor, but more probably a physician, who would surely face a herculean task, and might even meet with some opposition in his efforts to secure passengers for that particular vehicle. It is believed that with a capable inspection service, for the system necessarily requires the establishment of just this, some 10 per cent of consumptives could be enticed, coaxed or driven into

a car of this character. In no instance could a coach be filled to its capacity, and it is to be feared that the railroads would soon learn the unprofitableness of the venture. In that case would the invalids or Government be forced to bear the expense? No one can deny that the entire scheme is a totally impracticable arrangement, impossible of carrying into effect on account of the opposition which would develop from all sides, expensive, and even unnecessary.

Segregation in the compartments of Pullman cars, a modification of the foregoing, is more adaptable. Whenever possible this is done at present, purchasers of tickets showing indications of illness being urged to secure drawing rooms or compartments, the agents even going so far at times as to refuse transportation unless this is done. The compartment then remains closed until the terminus is reached, when it is fumigated. One drawback to this is the expense which falls upon the individual, and the recent increase of rates for such space has augmented this still further. A second objection is that the greater part of the traffic, 80 per cent at least, is in day or tourist coaches, and it would be extremely difficult to divert it to the Pullmans. If a compartment were to be permanently reserved for such use the expense would again be a matter of consideration. It would appear, however, that this is the most feasible plan yet offered and probably could be executed with the least degree of difficulty, although naturally serious objections to it would be raised.

It is not difficult to see that any plan which has for its basis the recognition of the disease in the individual, an impossible procedure in more than a small minority of cases, and the segregation of those selected, is bound to meet not only with opposition but with great difficulty of enforcement; furthermore, it is doubtful under our present views if such regulations are at all necessary. The better sanitation of cars is however a necessity, and this, too, irrespective of whether they carry consumptives or not; it would therefore seem logical so to adjust our sanitary requirements as to render public vehicles safe at all times, giving special attention to those which travel to and from the resort cities or those which are deemed most dangerous.

It is to be presumed that the institution of measures of this character would be accomplished through promulgation of amendments to the existing interstate quarantine regulations, the standardization of present methods used in the sanitation of cars, the introduction of whatever new methods are deemed advisable, and the institution of regulations to be observed by passengers while in transit.

We are of the opinion that too great consideration can not be attached to the cleaning of cars by compressed air, and that the system should be in far more general use than at present. It is impossible to reach the recesses and crevices of the ordinary coach by any

other means, dirt and dust, the two great vehicles of infection, being certain to accumulate, rendering the car insanitary. Without compressed air no car can be thoroughly cleaned, the sweeping and mopping of floors serving but to distribute the filth in the various recesses, there to remain for months. As an agent in the cleaning of mattresses, bedding, and upholstery, it is ideal; it eliminates dust and is altogether the most rapid, the cheapest, and the most scientific method for the treatment of cars, being an essential basis for all further steps in their sanitation. The frequency of the use of this process is a matter to be settled, but as the method serves as a substitute for sweeping and the brushing of upholstery, once the system is installed it would be used at all times when the cars come into the yards for treatment.

Within recent years our ideas regarding the benefits of disinfection have greatly changed, and opinions concerning the value of the fumigation of rooms following infectious diseases have been modified. No one now believes that disease is spread through some mysterious power of the atmosphere, but that microorganisms are conveyed through particles of dust remains unquestioned. In the controversy which has been waged no one has denied that the systematic disinfection of rooms occupied by consumptives was other than necessary, it probably being more essential than in any other infectious disease, although serious doubt has been raised as to the efficacy of this or that particular method.

The possibility of the fumigation of all railway coaches at stated intervals arises. It is probably true that much of the work done along that line at present is ineffective, gives only a false sense of security, and is a mere outward compliance with the law, but these are hardly sufficient reasons for condemning fumigation when properly carried out. The process is an extremely simple one as far as railway coaches are concerned, occupies but a few hours, can be performed by the average laborer, and is relatively inexpensive. Coaches traveling to and from the chief resorts cities should unquestionably be treated in this manner at frequent intervals.

If a system of fumigation were adopted it would require the use of formaldehyde, the only gas applicable to railway cars, others being injurious to fabrics or having other disadvantages. Some doubt has arisen concerning the worth of this method especially in the absence of moisture, the gas itself not being germicidal, and in the dry atmosphere of the health belt the difficulty would be even greater. The only alternative would be the use of a disinfectant spray from a compressed-air generator. This method also has the advantage of cheapness, is much more generally used abroad than in our own country, and is claimed by the newer exponents of disinfection to be vastly

superior to the generation of gas, besides offering a large range of disinfectants from which to select.

Whenever a car is disinfected by the foregoing method, a record of such disinfection should be kept where it is easily accessible. Such a record should give the place of disinfection, the date, the number of hours of exposure, and the name of the person doing the work.

Some provision should be made toward providing every car with a certain number of cuspidors of standard size. They should be non-capsizable, easily cleaned, and of such material that chipping or eroding of their surfaces is impossible. A disinfectant solution of known coefficient should be used, and their bottoms should be kept covered with this at all times. The strength of formaldehyde solution ordinarily used is 5 per cent, and under ordinary circumstances this is sufficient if there has been no evaporation of the liquid by heat, but too frequently cuspidors become dry while in transit, hence there is no disinfectant action whatever. The cleaning of all sputum receptacles within cars should be forbidden, and steaming required at terminals for the purposes of disinfection.

Many other suggestions will offer themselves. The sale of unoccupied portions of sections occupied by the tuberculous should be prohibited, and the further use of such sections after being vacated should not be allowed until the car has undergone fumigation. The third sheet for bedding has passed from a sanitary innovation to a sanitary necessity. Dental lavatories should be installed and all cars supplied with liquid soap. The laundry work of Pullman and other cars is performed in various cities of the country, and while the majority of laundries treat their straight white goods by boiling, this is not always the case; sterilization of linen in this manner should therefore be required. The cleaning of cars in transit, especially dry sweeping and dry dusting, should be forbidden. Some limit should also be placed upon the distance traveled, or the time in service, of day coaches without undergoing cleaning. Provision should be made for the proper cleansing of refrigerators, lockers, and drawers of dining and buffet cars. The occupancy of such cars for sleeping purposes by waiters and porters is to be deprecated, but of course this is a necessity; a place for the proper storing of mattresses and bedding away from all food products is essential. Water coolers and individual drinking cups are already provided for under present regulations.

Summary.

1. Consumptives are frequently occupants of railway coaches going to and from the resorts.

2. The number of consumptives traveling to and from the resort towns of the Southwest is increasing.

3. A large proportion are in a far-advanced stage of the disease.

4. The proportion of far-advanced cases is decreasing.

5. Proper precautions to prevent the spread of infection are observed by only a small per cent of the afflicted.

6. The greatest number of consumptives occupy day coaches, next the tourist Pullmans, and least the standard Pullmans.

7. The sanitation of Pullman cars is systematized, the instructions are specific, and the work is generally carefully performed.

8. The majority of other coaches are imperfectly cleaned.

9. The traveling public is responsible for many of the evil conditions which exist.

10. Railway coaches are a possible source of infection in tuberculosis.

11. Whether they are or not, their sanitation should be regulated.

12. As with other public health problems, the control of the migration of the tuberculous in interstate traffic is largely a question of education. In bringing this about, the adoption and enforcement of reasonable regulations to improve car sanitation and the personal hygiene of travelers are to be desired.

[This article will be continued in a subsequent issue.]

PLAGUE-PREVENTION WORK.

CALIFORNIA.

The following reports of plague-prevention work in California have been received from Passed Asst. Surg. Hurley, of the United States Public Health Service, in temporary charge of the work:

Week Ended Mar. 13, 1915.

San Francisco, Cal.

RAT PROOFING.	
New buildings:	
Inspections of work under construction	324
Basements concreted (31,448 square feet)	37
Floors concreted (36,776 square feet)	13
Yards, passageways, etc. (32,143 square feet)	97
Total area of concrete laid (square feet)	100,367
Class A, B, and C (fireproof) buildings:	
Inspections made	261
Roof and basement ventilators, etc. screened	3,420
Wire screening used (square feet)	17,230
Openings around pipes, etc., closed with cement	10,271
Sidewalk lens lights replaced	14,682
Old buildings:	
Inspections made	704
Wooden floors removed	60
Yards and passageways, planking removed	15
Cubic feet new foundation walls installed	7,340

RAT PROOFING—continued.	
Old buildings—Continued.	
Concrete floors installed (59,234 square feet)	49
Basements concreted (13,172 square feet)	16
Yards and passageways, etc., concreted (18,449 square feet)	61
Total area concrete laid (square feet)	81,855
Floors rat-proofed with wire cloth (12,491 square feet)	9
Buildings razed	9
New garbage cans stamped approved	288
Nuisances abated	352

OPERATIONS ON THE WATER FRONT.	
Vessels inspected for rat guards	14
Reinspections made on vessels	35
New rat guards procured	10
Defective rat guards repaired	11
Vessels on which cargo was inspected	1